Department of Toxic Substances Control

Matthew Rodriquez
Secretary for
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Barbara A. Lee, Director
8800 Cal Center Drive
Sacramento, California 95826-3200

Edmund G. Brown Jr.
Governor

April 24, 2018

Mr. Peter Zorba
NASA
5800 Woolsey Canyon Road
Canoga Park, California 91304

FORMER LIQUID OXYGEN PLANT AREA OF IMPACTED GROUNDWATER, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA

Dear Mr. Zorba:

The Department of Toxic Substances Control (DTSC) reviewed the *Draft Former LOX Plant AIG Data Evaluation Report* (Report, NASA, May 2017). The Report was submitted as Appendix A (Volume 2) of the NASA Groundwater RFI Report for the Santa Susana Field Laboratory.

Attached is a technical memorandum from DTSC's Geologic Services Branch presenting comments on the Report. Please review the comments and begin preparing responses. DTSC would like to meet with NASA by May 24, 2018, to discuss the responses to comments and revisions to the Report.

If you have any questions, please contact me at Roger.Paulson@dtsc.ca.gov or at (916) 255-3702.

Sincerely,

Roger Paulson, PE, Chief
Santa Susana Field Laboratory Unit
Department of Toxic Substances Control

Attachment: *DTSC Geologic Services Branch Technical Memorandum dated April 24, 2018*

cc: (see next page)

Printed on Recycled Paper

cc: (via e-mail)

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MEMORANDUM

TO: Roger Paulson P.E., Chief
Santa Susana Field Laboratory Unit
Brownfields and Environmental Restoration Program

FROM: Thomas Seckington, P.G. 6460, C.HG. 739
Senior Engineering Geologist, Geological Services Unit
Geologic Services Branch
Brownfields and Environmental Restoration Program

PROFESSIONAL GEOLOGIST
Thomas Micheal Seckington
No. 6460
STATE OF CALIFORNIA

DATE: April 24, 2018

SUBJECT: DRAFT VOLUME 2, APPENDIX A, FORMER LOX PLANT AIG DATA EVALUATION REPORT SANTA SUSANA FIELD LABORATORY, MAY 2017

Project: 900274-48 Activity: 22120

The Department of Toxic Substances Control (DTSC) Geologic Services Unit (GSU) reviewed and developed the following comments on the *Draft Volume 2, Appendix A, Former LOX Plant AIG Data Evaluation Report* (LOX Report, May 2017), prepared for the National Aeronautics and Space Administration (NASA).

The stated objectives of the LOX Report are to summarize site histories and relevant site investigations, and present the SCM for former Liquid Oxygen (LOX) Plant Area of Impacted Groundwater (AIG) at Santa Susana Field Laboratory (SSFL). The LOX Report presents geologic and hydrogeologic interpretations, and evaluates the nature and extent and fate and transport of chemicals of concern (COCs) in saturated and unsaturated bedrock at the LOX AIG.

The LOX Report is one of five documents that make up the NASA Groundwater RFI Report for SSFL (May 2017) The structure of the Groundwater RFI Report submittal includes five volumes; made up of a summary report (Volume 1) and four AIG reports:

- Former Liquid Oxygen (LOX) Plant AIG (Volume 2, Appendix A);
- Building 204/Expendable Launch Vehicle (B204/ELV) AIG (Volume 3, Appendix B);
- Alfa/Bravo AIG (Volume 4, Appendix C); and
- Coca/Delta AIG (Volume 5, Appendix D).

This memorandum provides GSU comments on the Former Liquid Oxygen (LOX) Plant AIG (Volume 2, Appendix A). Review of Volumes 1, 3, 4 and 5 is ongoing and comments on those documents will be submitted to NASA under separate cover.

If you have any questions or need additional information, please contact me at : (714) 484-5424 or tom.seckington@dtsc.ca.gov.

GENERAL COMMENTS

1. Aquifer testing at the former LOX Plant AIG, and at the other AIG sites, utilized the injection of potable water into an injection well(s). Baseline groundwater quality sampling events were conducted prior to injection activities but it is not clear whether the groundwater quality in subsequent sampling events was evaluated to determine short-term and long-term effects on the groundwater quality from the injections.

   A discussion of these effects, if any, should be included in the LOX Report, or other applicable RFI/Groundwater Monitoring report.

2. The lateral and vertical extent of groundwater contamination needs further refinement. The vertical extent of the groundwater contamination at the primary source (LOX-SA-1) is not defined. Figure 2-46 showing a cross-section through the source area illustrates that the lower boundary of the groundwater plume is not defined. An additional deeper well should be placed in this area to monitoring the contaminant plume at depth.

   Further, there are no monitoring point located north or east of the LOX-SA-1 area to constrain the groundwater plume in these directions. Given the current groundwater flow direction and the presence of Shale 2, it is not anticipated that groundwater contamination would extend significantly in these directions, however, monitoring locations should be placed north and east of the LOX-SA-1 area to collect data to verify this and for remedy performance and long-term monitoring.

SPECIFIC COMMENTS

1. 1.1 Introduction and Site Background
   Page 1-1; 2nd paragraph
   "The objectives of this data evaluation report are to summarize site histories and relevant site investigations and present the SCM for the B204/ELV AIG geology, hydrogeology, nature and extent of chemicals of concern (COCs) in the vadose and saturated zones of the CFOU, and groundwater COC fate and transport."

   The text needs to be revised to reflect that this Appendix A addresses the former LOX Plant AIG not the B204/ELV AIG.

2. 1.3.2 Data Gap Sampling and Analysis
   Page 1-5; 1st paragraph
   "No data have been collected from monitoring well WS-12 since 2008, before publication of the Data Gap SAP; in 2010, however, monitoring well RD-52A was sampled three times and showed decreasing concentrations for TCE (1,700 to 1,100 micrograms per liter [µg/L]) and cis-1,2-DCE (600 to 480 µg/L)."

   Please clarify the three dates when RD-52A was sampled.

3. 2.0 Site Conceptual Model
   Page 2-1; 7th paragraph
   "Historic chlorinated VOC concentrations measured over the past 25 years in wells proximal and distal to the source area indicate that concentrations of TCE have remained essentially stable since 1990 in most wells, presumably due to the breakdown of TCE to cis-1,2-DCE at rates similar to the mass flux leaving the source area. Consequently, levels of cis-1,2-DCE have shown a modest increase since 1990 in wells downgradient of the source area."

   The explanation for the observed stability of the TCE concentrations is not supported. Further work, including further compound specific isotope analysis (CSIA) and/or microcosm bench scale studies, may be needed as part of the remedy selection and implementation activities to conclusively identify any natural degradation pathways.

4. 2.1.2 Field Mapping
   Page 2-3; 4th paragraph
   "Water had infiltrated into the ground and had migrated first through the minor vertical fracture and then laterally once the layered siltstone unit was encountered."

   It should be clearly noted that water/contaminants will continue to move vertically

through the layered siltstone unit and fractures contained within it. The relatively small volume of water moving vertically through the finer-grained unit versus laterally along the contact between the sandstone and siltstones is dependent on the hydraulic conductivity contrast between the different lithologies.

Further, this generalized model of water/contaminant movement may not be appropriate near or within fault zones where the different rock types are more fractured and vertical and lateral flow through the fractures dominants.

5. 2.1.2 Field Mapping
   Page 2-4; 1st paragraph
   "Along the bottom of the valley to the southeast of the former LOX Plant AIG..."

   Please clarify if the "valley" refers to the North Drainage or other location. A figure showing this feature may be helpful.

6. 2.2.4 Groundwater Evaluations and Flow
   Page 2-10; 2nd paragraph
   "Once this infiltrating water encounters the CFGW, it migrates along one of two general flow pathways: (1) vertically to the deeper regional aquifers, or (2) outward toward and potentially discharging to seeps, springs, and/or phreatophytes located along the SSFL perimeter (MWH, 2009a)."

   The LOX Report should be revised to reflect that the potential pathways are not limited to two but instead, is a continuum between the two.

7. 2.2.3 Hydraulic Properties – AIG Characterization Data

   The constant rate injection test conducted in RD-80 is documented in Appendix 7A and referenced in this section. Analysis of the draw-up data was conducted by fitting early, middle, and late time data separately and by applying a multilayer analysis model (MLU). The GSU was able to obtain good representations of nearly the entire draw-up record in several wells (e.g. WS-13, RD-04A, RD-52C), however, by fitting an unconfined (Neuman) solution. The report should address the possibility that that vertical fractures/faults may cause the North Fault Zone to behave as an unconfined aquifer and comment on whether this might have bearing on fate and transport at the LOX AIG. Also, draw-up data should be included in the report to support independent verification of the interpretation.

8. 2.2.4.1 Historical Groundwater Pumping
   Page 2-10

   The LOX Report should be revised to acknowledge that groundwater elevations during the operations at the site were much lower than those observed today and as a result releases at the surface/subsurface would have penetrated deeper than the current groundwater elevations.

9. 2.2.4.2 Near-surface Groundwater
   Page 2-10

   The LOX Report should be revised to describe the nature of the near-surface groundwater. The section stated that the near-surface groundwater is transient but it is not clear if the near-surface groundwater is continuous with the underlying Chatsworth Formation groundwater or if it is perched.

10. 2.3.2.2 Vadose Zone Mass Estimate
    Page 2-18 and Appendix A

    The GSU has concerns regarding the vadose zone mass quantitative estimate. The estimate is dependent on the assumption that the VOC concentrations measured during the pre- and post-extraction passive gas sampling events are representative of the same VOC mass that was actively extracted. The pre-extraction passive gas sampling measured the equilibrated gas-phase concentrations of VOCs. In contrast, the vapor extraction system created transient, non-equilibrium conditions by pulling mass from a broader area within the fractures and rock matrix. Further, it was not demonstrated that the post-extraction passive gas sampling was completed after equilibrium conditions had returned or how long it would take for equilibrium conditions to return. Further sampling and evaluation is warranted to support this approach for calculating the VOC mass in the vadose zone.

    Direct measurement of the VOCs concentrations in the vadose zone bedrock may be needed to ascertain better estimates of the VOC mass present. The scope of this work, if needed, would be dependent on the remedy selection and design requirements and could be completed during those activities.

Reviewed by: Buck King, P.G., C.HG
Matthew Becker, PhD